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TITLE:	REMOTELY CONTROLLING VEHICLE FUNCTIONS
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REMOTELY CONTROLLING VEHICLE FUNCTIONS

FIELD OF THE INVENTION

This invention relates generally to telematics systems. In particular the invention relates to a system and method remotely controlling vehicle functions.

BACKGROUND OF THE INVENTION

One of the fastest growing areas of communications technology is related to automobile network solutions. The demand and potential for wireless vehicle communication, networking and diagnostic services have recently increased. Although many vehicles on the road today have limited wireless communication functions, such as unlocking a door and setting or disabling a car alarm, new vehicles offer additional wireless communication systems that help personalize comfort settings, run maintenance and diagnostic functions, place telephone calls, access call-center information, update controller systems, determine vehicle location, assist in tracking vehicle after a theft of the vehicle and provide other vehicle-related services. Drivers can call telematics call centers and receive navigational, concierge, emergency, and location services, as well as other specialized help such as locating the geographical position of a stolen vehicle and honking the horn of a vehicle when the owner cannot locate it in a large parking garage. Telematics service providers can offer enhanced telematics services by supplying a subscriber with a digital handset.

Vehicle lock and unlock services and alerts provided by a telematics call center requires that the call center receive a communication from a subscriber requesting the service. The service center must then verify the subscriber's identity before providing the service to the subscriber. This required intervention increases the cost of supplying telematics services to subscribers. The delay caused by routing the service request through the call center is an inconvenience to the subscriber. These services are often required in time sensitive situations and need to occur with minimal delay.

It is desirable therefore, to provide a system and method for remotely controlling vehicle functions, that overcomes the challenges and obstacles described above.

SUMMARY OF THE INVENTION

The current invention provides a method for remotely controlling vehicle functions. A call signal is received at a telematics unit from a remote communication device, the call signal including an automatic number identification. A determination is made whether the automatic number identification corresponds to a services authorized number. A services selection message is sent based on the determination. A user response signal to the services selection message is monitored for and a vehicle function command signal is sent based on the user response signal.

Another aspect of the current invention provides a computer usable medium including computer program code for remotely controlling vehicle functions. Computer program code receives a call signal at a telematics unit from a remote communication device, the call signal including an automatic number identification. Computer program code determines whether the automatic number identification corresponds to a services authorized number. Computer program code sends a services selection message based on the determination. Computer program code monitors for a user response signal to the services selection message and sends a vehicle function command based on the user response signal.

Another aspect of the current invention provides a system for remotely controlling vehicle functions. The system comprises means for receiving a call signal at a telematics unit from a remote communication device, the call signal including an automatic number identification; means for determining whether the automatic number identification corresponds to a services authorized number; means for sending a services selection message based on the determination;

means for monitoring for a user response signal to the services selection message; and means for sending a vehicle function command based on the user response signal

The aforementioned and other features and advantages of the invention will become further apparent from the following detailed description of the presently preferred embodiment, read in conjunction with the accompanying drawings. The detailed description and drawings are merely illustrative of the invention rather than limiting, the scope of the invention being defined by the appended claims and equivalents thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic diagram of a system for remotely controlling vehicle functions in accordance with one embodiment of the current invention;

FIG. 2 is a flow diagram of a method for remotely controlling vehicle functions in accordance with one embodiment of the current invention;

FIG. 3 is a flow diagram detailing the step of determining whether the automatic identification corresponds to a services authorized number at block **230** of **FIG.2**;

FIG. 4 is a flow diagram detailing the step of comparing the automatic number identification of the received call signal to the services authorized numbers in the automatic number identification table at block **330** of **FIG.3**; and

FIG. 5 is a flowchart detailing the step of sending a vehicle function command at block **280** of **FIG. 2**.

DETAILED DESCRIPTION OF THE
PRESENTLY PREFERRED EMBODIMENTS

FIG. 1 is a schematic diagram of a system for remotely controlling vehicle functions in accordance with one embodiment of the current invention at **100**. System for remotely controlling vehicle functions at **100** comprises: a mobile vehicle **110**, a telematics unit **120**, one or more wireless carrier systems **140**, or one or more satellite carrier systems **141**, one or more communication networks **142**, and one or more call centers **180**. Mobile vehicle **110** is a vehicle such as a car or truck equipped with suitable hardware and software for transmitting and receiving speech and data communications. Vehicle **110** has a multimedia system **118** having one or more speakers **117**.

In one embodiment of the invention, telematics unit comprises: a digital signal processor (DSP) **122** connected to a wireless modem **124**; a global positioning system (GPS) receiver or GPS unit **126**; an in-vehicle memory **128**; a microphone **130**; one or more speakers **132**; an embedded or in-vehicle phone **134** or an email access appliance **136**; and a display **138**. DSP **122** is also referred to as a microcontroller, controller, host processor, or vehicle communications processor. GPS unit **126** provides longitude and latitude coordinates of the vehicle, as well as a time stamp and a date stamp. In-vehicle phone **134** is an analog, digital, dual-mode, dual-band, multi-mode or multi-band cellular phone.

Telematics unit **120** can store service center GPS location data, vehicle data upload (VDU) records, automatic number identification (ANI) tables and other data files in in-vehicle memory **128**. Telematics unit **120** can set or reset calling-state indicators and can enable or disable various cellular-phone functions, telematics-unit functions and vehicle functions when directed by program code running on DSP **122**. Telematics unit **120** can send and receive over-the-air messages using, for example, a pseudo-standard air-interface function or other proprietary and non-proprietary communication links.

DSP **122** executes various computer programs and computer program code, within telematics unit **120**, that affect programming and operational modes of electronic and mechanical systems. DSP is also referred to as a microcontroller, controller, ASIC, host processor, microprocessor or vehicle communication processor. DSP **122** controls communications between telematics unit **120**, wireless carrier system **140** or satellite carrier system **141** and call center **180**. A speech-recognition engine **119** (ASR), which can translate human speech input through microphone **130** to digital signals used to control functions of telematics unit, is installed in telematics unit **120**. The interface to telematics unit **120** includes one or more buttons (not shown) on telematics unit **120**, on multimedia system **118**, or on an associated keyboard or keypad that are also used to control functions of telematics unit. A text to speech synthesizer **121** can convert text strings to audible messages that are played through speaker **132** of telematics unit **120** or through speakers **117** of multimedia system **118**.

Speech recognition engine **119** and buttons are used to activate and control various functions of telematics unit **120**. For example, programming of in-vehicle phone **134** is controlled with verbal commands that are translated by speech-recognition software executed by DSP **122**. Alternatively, pushing buttons on interface of telematics unit **120** or on in-vehicle phone **134** is used to program in-vehicle phone **134**. In another embodiment, the interface to telematics unit **120** includes other forms of preference and data entry including touch-screens, wired or wireless keypad remotes, or other wirelessly connected devices such as Bluetooth-enabled devices or 802.11-enabled devices.

DSP **122** controls, generates and accepts digital signals transmitted between telematics unit **120** and a vehicle communication bus **112** that is connected to various vehicle components **114**, various sensors **116**, and multimedia system **118** in mobile vehicle **110**. DSP **122** can activate various programming and operation modes, as well as provide for data transfers. In one embodiment of the invention, DSP **122** converts user response signals to vehicle function commands. Vehicle function commands are sent to a control entity that controls a vehicle function via communication bus **112**. Vehicle function commands instruct the control entity to execute the vehicle function. Examples of controllable vehicle functions comprise door lock and unlock, flash lights and honk horn. Examples of control entities comprise a powertrain control module (PCM), a body control module (BCM), an electronic control module (ECM), and a theft deterrent control module.

Mobile vehicle **110** via telematics unit **120** sends and receives radio transmissions from wireless carrier system **140**, or satellite carrier system **141**. Wireless carrier system **140**, or satellite carrier system **141** is any suitable system for transmitting a signal from mobile vehicle **110** to communication network **142**.

Communication network **142** includes services from mobile telephone switching offices, wireless networks, public-switched telephone networks, and Internet protocol (IP) networks. Communication network **142** comprises a wired network, an optical network, a fiber network, another wireless network, or any combination thereof. Communication network **142** connects to mobile vehicle **110** via wireless carrier system **140**, or satellite carrier system **141**.

Communication network **142** can send and receive short messages according to established protocols such as dedicated short range communication standard (DSRC), IS-637 standards for short message service (SMS), IS-136 air-interface standards for SMS, and GSM 03.40 and 09.02 standards. In one embodiment of the invention, similar to paging, an SMS communication is posted along with an intended recipient, such as a communication device in mobile vehicle **110**.

Call center **180** is a location where many calls are received and serviced at the same time, or where many calls are sent at the same time. In one embodiment of the invention, the call center is a telematics call center, prescribing communications to and from telematics unit **120** in mobile vehicle **110**. In another embodiment, the call center **180** is a voice call center, providing verbal communications between a communication service advisor **185**, in call center **180** and a subscriber. In another embodiment, call center **180** contains each of these functions.

Communication services advisor **185** is a real advisor or a virtual advisor. A real advisor is a human being in verbal communication with a user or subscriber. A virtual advisor is a synthesized speech interface responding to requests from user or subscriber. In one embodiment, virtual advisor includes one or more recorded messages. In another embodiment, virtual advisor generates speech messages using a call center based text to speech synthesizer (TTS). In another embodiment virtual advisor includes both recorded and TTS generated messages.

Call center **180** provides services to telematics unit **120.** Communication services advisor **185** provides one of a number of support services to a subscriber. Call center **180** can transmit and receive data via data signal, such as vehicle data upload (VDU) to telematics unit **120** in mobile vehicle **110** through wireless carrier system **140**, satellite carrier systems **141**, or communication network **142**.

Call center **180** can determine mobile identification numbers (MINs) and telematics unit identifiers associated with a telematics unit access request, compare mobile identification numbers and telematics unit identifiers with a database of identifier records, and send calling-state messages to the telematics unit **120** based on the request and identification numbers.

In one embodiment of the invention call signals are received at telematics unit **120**. Call signals are received by telematics unit **120** through embedded phone **134**. Call signals are incoming phone calls sent via a service provider selected by the subscriber. Call signals include an automatic number identification that identifies a phone number, a name of the party from whom the call signal originates, or both. A call signal is initiated using a remote communication device, such as a digital handset **160**. The digital handset is a portable phone provided by the subscriber's telematics service provider

Telematics unit **120** has appropriate software enabling it to read the automatic number identification associated with each call signal received. DSP **122** runs program code for comparing the automatic number identification of a call signal to a list of services authorized numbers on an automatic number identification table stored in memory **128**. The automatic number identification table comprises a list of phone numbers that are services authorized numbers. Each services authorized number corresponds to a remote communication device from which a subscriber can access the system for remotely controlling vehicle functions. Examples of remote communication devices are a digital handset **160**, a handheld device **170** such as a personal digital assistant (PDA), and a user computer **150**.

User computer **150** or a handheld device **170** has a wireless modem to send data through wireless carrier system **140**, or satellite carrier system **141**, which connects to communication network **142**. In another embodiment User computer **150** or a handheld device **170** has a wired modem, which connects to communications network **142**. Data is received at call center **180**. Call Center **180** has any suitable hardware and software capable of providing web services to help transmit messages and data signals from User computer **150** or a handheld device **170** to telematics unit **120** in mobile vehicle **110**. User computer **150** or a handheld device **170** can send a user response signal for remotely controlling vehicle functions.

FIG. 2 is a flow diagram of a method for remotely controlling vehicle functions in accordance with one embodiment of the current invention at **200**. The method for remotely controlling vehicle functions at **200** begins (block **205**) with the telematics unit receiving a call signal with an associated automatic number identification (block **210**). The telematics unit is in a wake-up or a resume state to accept call signals and allow remote control of vehicle functions (block **220**). If the telematics unit is not in wake-up or resume state, the call signal terminates (block **225**) and the method ends (block **295**). In another embodiment of the invention, the call signal is forwarded to the call center when the telematics unit is not in wake-up or resume state.

When the unit is in wake-up or resume state, the call signal is connected (block **230**) and it is determined whether the automatic number identification associated with the incoming call signal corresponds to a services authorized number on an automatic number identification table (block **240**). For a digital handset solution (DHS) subscriber, the digital handset is assigned a handheld mobile identification number (MIN). The handheld MIN is written as a services authorized number on the ANI table. Other numbers such as a phone number assigned to a non-DHS handset or a subscriber's home or business phone

number are written to the ANI table as requested by the subscriber. The telematics unit is assigned a portable MIN. The portable MIN is the phone number a subscriber enters to remotely control vehicle functions.

When the determination is made, a services selection message is sent (block **250**). The services selection message is a voice message listing the vehicle functions that can be controlled with a number associated with each of the vehicle functions listed. The services selection message comprises synthesized speech directing the subscriber to select the desired vehicle function for control.

A user response signal in reply to the services selection message is monitored for (block **260**). The user response signal is an electronic signal received at the telematics unit. Examples of electronic signals are a touch-tone sent when a handset key is pressed, a data packet sent when a computer key is pressed or a user utterance when a subscriber speaks. In one embodiment of the invention, when the subscriber presses the number corresponding to the desired vehicle function, on the keypad of the digital handset, the user response signal is sent. In another embodiment of the invention, the user utters the number corresponding to the desired vehicle function. The user response signal is the user utterance. In another embodiment of the invention the user utters a phrase comprising the vehicle function for control, such as "unlock door" to select the unlock door function. A vehicle function command is sent based on the user response signal received (block **270**) and the method ends (block **295**).

FIG. 3 is a flow diagram detailing the step of determining whether the automatic number identification (ANI) corresponds to a services authorized number at block **230** of **FIG.2** at **300**. Determining whether the automatic number identification corresponds to a services authorized number begins (block **305**) when the automatic number identification of the call signal is read (block **310**). The stored automatic number identification table, which comprises one or more services authorized numbers, is read (block **320**). The automatic number

identification of the received call signal is compared to the services authorized numbers on the automatic number identification table (block **330**) and the step ends (block **395**).

FIG. 4 is a flow diagram detailing the step of comparing the automatic number identification of the received call signal to the services authorized numbers in the automatic number identification table at block **330** of **FIG.3** at **400**. The comparison begins (block **405**) when a determination is made if the automatic number identification of the received call signal matches at least one services authorized number in the automatic number identification table. The automatic number identification of the received call signal either matches a services authorized number in the automatic number identification table or does not match a services authorized number in the automatic number identification table (block **410**).

If the automatic number identification associated with the received call signal does not match at least one services authorized number on the automatic number identification table the call is connected via the normal process (block **420**) and the step ends (block **495**). The normal process is to treat the call as an incoming personal call and route the call signal to the embedded handset of the telematics unit or to a voicemail system.

If the automatic number identification associated with the received call signal does match at least one services authorized number on the automatic number identification table the call signal is connected to the telematics unit for vehicle function control (block **430**) and the step ends (block **495**). The telematics unit generates services selection messages and vehicle function command signals as well as monitoring for a user response signal sent in reply to a services selection message.

FIG. 5 is a flowchart detailing the step of sending a vehicle function command at block **280** of **FIG. 2** at **500**. The step of sending a vehicle function command begins (block **505**) when a selected vehicle function is determined from a received user response signal (block **510**). The vehicle function command corresponding to the selected vehicle function is determined (block **520**). The vehicle function command is routed to the control entity for the vehicle function (block **530**) and the step ends (block **595**).

While embodiments of the invention disclosed herein are presently considered to be preferred, various changes and modifications can be made without departing from the spirit and scope of the invention. The scope of the invention is indicated in the appended claims, and all changes that come within the meaning and range of equivalents are intended to be embraced therein.